UK Nuclear Activity

February 2016 Issue 32

In this issue,

Newsletter archive: http://npg.dl.ac.uk/OutreachNewsletter/index.html

Nuclear Physics Public Engagement Website: www.stfc.ac.uk/NuclearPhysicsForYou

Nuclear Physics Outreach Poster – order hardcopies from STFC free of charge here

---

1. Nuclear Physics Publications for February*

If you are publishing a paper that you think would be of media value please let Wendy Ellison wendy.ellison@stfc.ac.uk , STFC Press Officer, know. She can help with press releases and publicity. If you get in touch with her before publication she can also get material ready in advance for the day of publication.

Phys. Rev. C 93, 014620 (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.93.014620
Fission dynamics within time-dependent Hartree-Fock. II. Boost-induced fission
Philip Goddard, Paul Stevenson*, and Arnau Rios†
*Published 29 January 2016

Appl. Radiat. Isot. 108, 143 (2016) http://www.sciencedirect.com/science/article/pii/S0969804315303845
Half-life determination of the ground state decay of ^{111}Ag
S.M. Collins[a,*], A.V. Harms[a,1], P.H. Regan[a,b]
Published February 2016

Nature Phys. 12, 116 (2016) http://www.nature.com/nphys/journal/v12/n2/full/nphys3654.html
Nuclear physics: The skin of a nucleus
Daniel P. Watts
Published 2 February

Phys. Rev. C 93, 024905 (2016) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.93.024905
Centrality dependence of pion freeze-out radii in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV

*Also including missed publications from previous months.

ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, M. Borri, M. Chartier, D. Evans, M.A.S. Figueredo, K.L. Graham, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
Published 4 February 2016

Phys. Rev. C 93, 021601(R) (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.93.021601
Structure of ^{107}Sn studied through single-neutron knockout reactions
G. Cerizza[1,*], A. Ayres[1], K. L. Jones[1], R. Grzywacz[1], A. Bey[1], C. Bingham[1], L. Cartegni[1], D. Miller[1,†], S. Padgett[1,‡], T. Baugher[2,§], D. Bazin[2], J. S. Berryman[2], A. Gade[2], S. McDaniel[2], A. Ratkiewicz[2,‡], A. Shore[2], S. R. Stroberg[2,‖], D. Weisshaar[2], K. Wimmer[2,¶], R. Winkler[2], S. D. Pain[3], K. Y. Chae[3,**], J. A. Cizewski[4], M. E. Howard[4], and J. A. Tostevin[5]
Published 4 February 2016

Phys. Rev. C 93, 024307 (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.93.024307
Evolving collective structures in the transitional nuclei ^{162}W and ^{164}W
D. T. Joss[1], G. D. Dracoulis[2,*], E. Higgins[1], M. Lewis[1], J. Thomson[1], G. J. Lane[2], R. D. Page[1], J. Simpson[3], L. Bianco[1], B. Cederwall[4], I. G. Darby[1], P. M. Davidson[2], S. Eeckhaudt[5], S. Ertürk[6], B. Fabricius[2], M. B. Gómez-Hornillos[3], T. Grahn[5], P. T. Greenlees[5], B. Hadinia[4], U. Jakobsson[5], P. M. Jones[7], R. Julin[5], S. Juutinen[5], S. Ketelhut[5], M. Leino[5], P. Nieminen[5], M. Nyman[5], J. Pakarinen[5], E. S. Paul[1], P. Peura[5], P. Rahkila[5], P. Ruotsalainen[5], M. Sandzelius[5], P. J. Sapple[1], J. Sarén[5], C. Scholey[5], J. Sorri[5], and J. Uusitalo[5]
Published 5 February 2016

Nature Phys3645 (2016) http://www.nature.com/nphys/journal/vaop/ncurrent/full/nphys3645.html
Unexpectedly large charge radii of neutron-rich calcium isotopes
R. F. Garcia Ruiz, M. L. Bissell, K. Blaum, A. Ekström, N. Frömmgen, G. Hagen, M. Hammen, K. Hebeler, J. D. Holt, G. R. Jansen, M. Kowalska, K. Kreim, W. Nazarewicz, R. Neugart, G. Neyens, W. Nörtershäuser, T. Papenbrock, J. Papuga, A. Schwenk, J. Simonis, K. A. Wendt & D. T. Yordanov
Published 8 February

Phys. Lett. B 753, 182 (2016) http://www.sciencedirect.com/science/article/pii/S0370269315009740
Decay spectroscopy of ^{160}Sm: The lightest four-quasiparticle *K* isomer
Z. Patel[a,b,1], Zs. Podolyák[a], P.M. Walker[a], P.H. Regan[a,c], P.-A. Söderström[b], H. Watanabe[b,d,e], E. Ideguchi[f,g], G.S. Simpson[h], S. Nishimura[b], F. Browne[b,i], P. Doornenbal[b], G. Lorusso[b,c], S. Rice[a,b], L. Sinclair[b,k], T. Sumikama[l], J. Wu[b,i], Z.Y. Xu[m], N. Aoi[f,g], H. Baba[b], F.L. Bello Garrote[n], G. Benzoni[o], R. Daido[g], Zs. Dombrádi[v], Y. Fang[g], N. Fukuda[b], G. Gey[h], S. Go[p], A. Gottardo[q], N. Inabe[b], T. Isobe[b], D. Kameda[b], K. Kobayashi[r], M. Kobayashi[p], T. Komatsubara[s,t], I. Kojouharov[u], T. Kubo[b], N. Kurz[u], I. Kuti[v], Z. Li[w], H.L. Liu[x], M. Matsushita[p], S. Michimasa[p], C.-B. Moon[y], H. Nishibata[g], I. Nishizuka[l], A. Odahara[g], E. Şahin[n], H. Sakurai[b,m], H. Schaffner[u], H. Suzuki[b], H. Takeda[b], M. Tanaka[g], J. Taprogge[z,aa], Zs. Vajta[v], F.R. Xu[i], A. Yagi[g], R. Yokoyama[p]
10 February 2016

Phys. Lett. B 753, 41 (2016) http://www.sciencedirect.com/science/article/pii/S0370269315009156
Elliptic flow of muons from heavy-flavour hadron decays at forward rapidity in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV
ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, M. Borri, M. Chartier, D. Evans, M.A.S. Figueredo, K.L. Graham, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
Published 10 February 2016

Phys. Lett. B 753, 126 (2016) http://www.sciencedirect.com/science/article/pii/S0370269315009533
Forward-central two-particle correlations in p–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV
ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, M. Borri, M. Chartier, D. Evans, M.A.S. Figueredo, K.L. Graham, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
Published 10 February 2016

Phys. Lett. B 753, 319 (2016) http://www.sciencedirect.com/science/article/pii/S0370269315009788
Pseudorapidity and transverse-momentum distributions of charged particles in proton–proton collisions at $\sqrt{s}$ = 13 TeV

ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, M. Borri, M. Chartier, D. Evans, M.A.S. Figueredo, K.L. Graham, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
Published 10 February 2016

Phys. Lett. B 753, 511 (2016) http://www.sciencedirect.com/science/article/pii/S0370269315009958
Azimuthal anisotropy of charged jet production in $\sqrt{s_{NN}}$ = 2.76 TeV Pb–Pb collisions
ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, M. Borri, M. Chartier, D. Evans, M.A.S. Figueredo, K.L. Graham, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
Published 10 February 2016

J. Phys. G: Nucl. Part. Phys. 43 04LT01 (2016)
http://iopscience.iop.org/article/10.1088/0954-3899/43/4/04LT01
Ab initio derivation of model energy density functionals
Jacek Dobaczewski[1,2,3,4]
Published 15 February 2016

Eur. Phys. J. C (2016) 76:86 http://link.springer.com/article/10.1140/epjc/s10052-016-3915-1
Multiplicity and transverse momentum evolution of charge-dependent correlations in pp, p–Pb, and Pb–Pb collisions at the LHC
ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, M. Borri, M. Chartier, D. Evans, M.A.S. Figueredo, K.L. Graham, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
Published 19 February 2016

Phys. Rev. C 93, 024318 (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.93.024318
Mirrored one-nucleon knockout reactions to the T_z=±3/2 A=53 mirror nuclei
S. A. Milne[1], M. A. Bentley[1], E. C. Simpson[2], P. Dodsworth[1], T. Baugher[3,4], D. Bazin[4], J. S. Berryman[4], A. M. Bruce[5], P. J. Davies[1], C. Aa. Diget[1], A. Gade[3,4], T. W. Henry[1], H. Iwasaki[3,4], A. Lemasson[4,6], S. M. Lenzi[7], S. McDaniel[3,4], D. R. Napoli[8], A. J. Nichols[1], A. Ratkiewicz[3,4], L. Scruton[1],S. R. Stroberg[3,4], J. A. Tostevin[9], D. Weisshaar[4], K. Wimmer[4,10], and R. Winkler[4]
Published 24 February 2016

---

2. News to Report

a. IOP Nuclear Physics Group Early Career Award 2015. This year's IOP Nuclear Physics Group (NPG) prize has been awarded to Dr Daniel Doherty (York) for his contributions towards the study of exotic nuclei and shape phenomena by means of Coulomb excitation. The prize consists of £250 and an invited talk at the up-coming IOP nuclear physics conference in Liverpool.

CONGRATULATIONS to Daniel and all the best for the future, on behalf of the IOP NPG committee. Nominations for the 2016 award will be opened in September see: http://www.iop.org/activity/groups/subject/np/prize/page_45155.html for details.

Contribution by Tzany Kokalova Wheldon t.kokalova@bham.ac.uk - Chair of the IOP NPG (Birmingham).

b. 2016 TALENT Courses. Applications are open for the 2016 TALENT courses.
The TALENT initiative, Training in Advanced Low Energy Nuclear Theory, aims to provide an advanced and comprehensive training to graduate students and young researchers in all aspects of low-energy nuclear theory.
General information on TALENT and past courses can be found at http://www.nucleartalent.org.
Three TALENT courses will be offered in 2016. The topics, principal lecturers, and application links are:
- Course 4: "Density Functional Theory and Self-Consistent Methods" at the University of York in York, UK, from July 17 to August 6, 2016. The principal lecturers will be Jacek Dobaczewski, Andrea Idini, Alessandro Pastore, and Nicolas Schunck. Apply at

https://academicjobsonline.org/ajo/jobs/6999. Deadline for applications is April 1, 2016. Contact: Jacek Dobaczewski (jacek.dobaczewski@york.ac.uk).
- Course 8: "Atomic Nuclei as Open Quantum Systems: Unifying Nuclear Structure and Reactions" at Chalmers University of Technology and Gothenburg University in Gothenburg, Sweden, from August 15 to September 2, 2016. The principal lecturers will be Christian Forssén, Witek Nazarewicz, Marek Ploszajczak, and Alexander Volya. Apply at https://academicjobsonline.org/ajo/jobs/6995. Deadline for applications is April 15, 2016. Contact: Christian Forssén (christian.forssen@chalmers.se).
- Course 9: "Quantum Monte Carlo Methods for Nuclear Physics and Related Areas" at North Carolina State University in Raleigh, North Carolina, from July 11 to July 29, 2016. The principal lecturers will include Joe Carlson, Joaquín Drut, Stefano Gandolfi, and Dean Lee. Apply at https://academicjobsonline.org/ajo/jobs/6881. Deadline for applications is March 31, 2016. Contact: Stefano Gandolfi (stefano@lanl.gov).
For additional information on each of the courses, please see http://www.nucleartalent.org.
Contribution by Jacek Dobaczewski Jacek.Dobaczewski@fuw.edu.pl (York).

c. Laser spectroscopy experiments open new questions on the evolution of nuclear sizes away from stability. Researchers from the Nuclear Physics group at the University of Manchester have contributed to recent experimental findings that pose new challenges to our understanding of the atomic nucleus. The experiments performed at ISOLDE, CERN, revealed an unexpected large charge radius increase in neutron-rich calcium isotopes. The results were recently published in *Nature Physics* (Garcia Ruiz *et al*., http://www.nature.com/nphys/journal/vaop/ncurrent/full/nphys3645.html).
Although the atomic nucleus is a complex many-body quantum system, it displays simple patterns and regular behaviors around certain number of protons and neutrons, commonly known as magic numbers: 2, 8, 20, 28, 50, 82, 126. To understand the origin and evolution of these magic structures in unstable nuclei has been one of the main challenges of the modern experimental and theoretical nuclear physics.
Having a magic number of protons, Z=20, the calcium isotopes represent a unique nuclear system. Two doubly-magic stable isotopes can be found in nature, ^{40}Ca and ^{48}Ca, for neutron numbers N=20 and N=28, respectively. Additionally, two new doubly-magic unstable isotopes were recently suggested: ^{52}Ca (Wienholtz *et al*., *Nature* 498 346, 2013) and ^{54}Ca (Steppenbeck *et al., Nature* 502 207, 2013).
By using high-resolution laser spectroscopy, the team of researchers measured for the first time the changes in the charge radius of the neutron-rich calcium isotopes ^{49,51,52}Ca. The large increase observed towards ^{52}Ca defies the doubly-magic nature previously suggested for this isotope, and largely exceeds the predictions from all of the available theoretical models. State-of-the-art ab-inito calculations (Hagen *et al*., *Nature Phys.* 12 186, 2016) have been able to reproduce the similar and smaller charge radii observed for ^{40}Ca and ^{48}Ca, but fall short of describing the large difference observed between ^{48}Ca and ^{52}Ca.
These results have opened new and intriguing questions on the evolution of nuclear sizes away from stability, which are of importance for our understanding of neutron-rich mater.
For more details see the press report from CERN at: http://home.cern/about/updates/2016/02/has-magic-gone-calcium-52, UK news from CERN: http://www.stfc.ac.uk/news-events-and-publications/publications/uk-news-from-cern/uknfc69/#two and CERN Courier: http://cerncourier.com/cws/article/cern/63960.
Contribution by Tobias Wright tobias.wright@manchester.ac.uk and Ronald Fernando Garcia Ruiz ronald.fernando.garcia.ruiz@cern.ch (Manchester).

d. Second Call for Abstracts: ANSRI 2016. A second workshop on the "Applications of Novel Scintillators for Research and Industry" (ANSRI 2016) will take place in the O'Brien Centre for Science at University College Dublin, Ireland from the 11th to 13th of May. The primary goal of this workshop is to address the shortfalls in current scintillator performance in various application areas and to identify new pathways for future

developments by bringing together experts from diverse backgrounds. Furthermore, the exchange of knowledge between research and industry experts will lead to the formation of new networks in this diverse and dynamic field. The workshop will host a mixture of invited and contributed talks, as well as a poster session. The abstract submission and early registration deadlines are the 18th of March and 15th of April, respectively. Proceedings will be published in the IoP Journal of Physics: Conference Series. More details about the workshop can be found at http://spacescience.ie/ansri2016/.
Contribution by Oliver Roberts oliver.roberts@ucd.ie (University College Dublin).

---

3. Outreach Activity

Outreach Lectures
Alison Laird gave a talk on Nuclear Astrophysics: from the lab to the stars at Wakefield Girls School to about 20 A level students on Wednesday 27th January.
Contribution by Alison Laird alison.laird@york.ac.uk (York).

Paddy Regan gave a talk entitled: 'The History, Nuclear Physics and Radiobiology of Polonium-210' on Thursday 4th February at the Cavendish Laboratory, Cambridge for the Cambridge Physics Centre to around 150 GCSE and A-level students plus teachers.
Contribution by Paddy Regan p.regan@surrey.ac.uk (Surrey).

Public Engagement Small Awards Scheme

The call for applications to the 2016A Small Awards round opened on Wed 17th February 2016. Applications will be accepted up to 4.00pm on Thu 28th April 2016.

The Public Engagement Small Awards Scheme provides funds for small, local or 'pilot' projects promoting STFC science and technology. Anyone can apply, including grant-funded research groups, STFC research facility users, schools, museums, etc. Awards range from £500 to £10,000 and the expenditure can go towards materials, salaries and travel & subsistence.
Projects must be relevant to publicising engagement or teaching about the STFC science and technology areas, namely: *particle physics; nuclear physics; space, solar and planetary science; astronomy; astrophysics; cosmology; studying materials with muon and neutron sources; studying materials with synchrotron light sources; research using laser facilities.*
All applications **must** be submitted through the RCUK Joint electronic submission (Je-S) system. E-mailed or hard copy applications will not be accepted. Please see the notes for guidance for further information.
Contact STFC Public Engagement Team.

---

4. Media Interactions